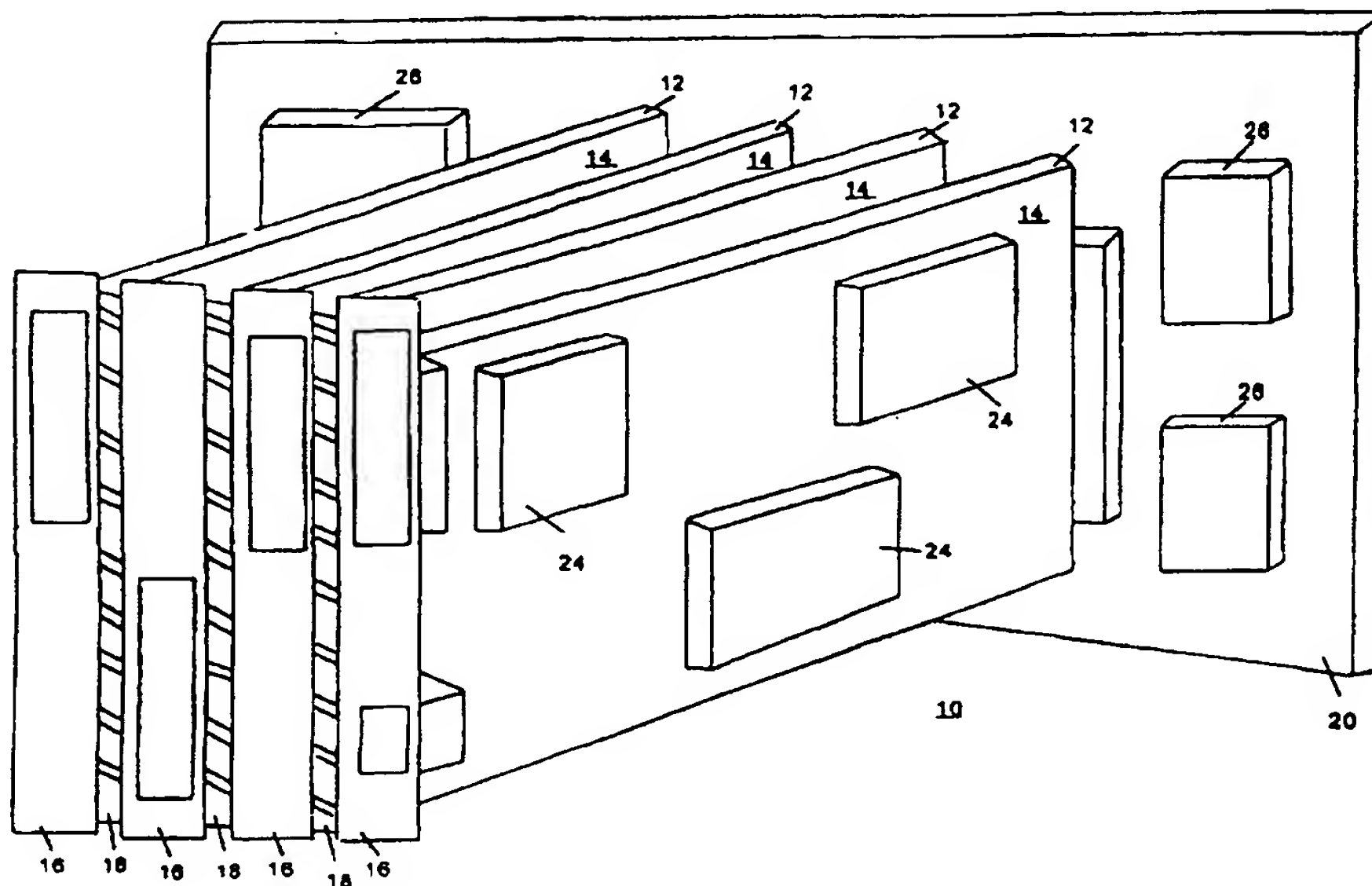




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H05K 9/00	A1	(11) International Publication Number: WO 97/23124 (43) International Publication Date: 26 June 1997 (26.06.97)
<p>(21) International Application Number: PCT/US96/20679</p> <p>(22) International Filing Date: 19 December 1996 (19.12.96)</p> <p>(30) Priority Data: 08/577,912 21 December 1995 (21.12.95) US</p> <p>(71) Applicant (for all designated States except US): INTEL CORPORATION [US/US]; 2200 Mission College Boulevard, Santa Clara, CA 95052 (US).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): LANGFORD, David [US/US]; 3745 N.W. Olympic Drive, Portland, OR 97229-3333 (US).</p> <p>(74) Agents: TAYLOR, Edwin, H. et al.; Blakely, Sokoloff, Taylor & Zafman L.L.P., 7th floor, 12400 Wilshire Boulevard, Los Angeles, CA 90025 (US).</p>		<p>(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>

(54) Title: APPARATUS FOR SEALING ELECTROMAGNETIC EMISSION



(57) Abstract

A longitudinal electromagnetic emission sealer is constituted with an elongated elastomer core and a thin helical skin wrapped around the core. The elongated elastomer core is made of a flexible material that allows the core to be compressed in volume when pressure is exerted on the sealer. The helical skin is made of a material that can absorb electromagnetic emissions, even at minimal thickness, allowing the skin to wrap around the core in a helical manner easily. Additionally, a groove complementary in size to the sealer is provided to one side of the bracket of each card module for securing in place the sealer between the brackets of two card modules.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	KZ	Kazakhstan	SG	Singapore
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovakia
CM	Cameroon	LR	Liberia	SN	Senegal
CN	China	LT	Lithuania	SZ	Swaziland
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	LV	Latvia	TG	Togo
DE	Germany	MC	Monaco	TJ	Tajikistan
DK	Denmark	MD	Republic of Moldova	TT	Trinidad and Tobago
EE	Estonia	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UG	Uganda
FI	Finland	MN	Mongolia	US	United States of America
FR	France	MR	Mauritania	UZ	Uzbekistan
GA	Gabon			VN	Viet Nam

5 **Apparatus For Sealing Electromagnetic Emission**

BACKGROUND OF THE INVENTION

1. **Field of the Invention**

10

The present invention relates to the field of digital systems. More specifically, the present invention relates to the art of containing electromagnetic emissions from a digital system.

15 2. **Background Information**

The problem of electromagnetic emission from a digital system is known in the art. One approach known in the art for reducing the electromagnetic emission to virtually nil for card module based digital systems is the clip approach. Under the clip approach, a clip that is longitudinal in size is provided in between the brackets of two neighboring card modules having electromagnetic emitting electronic components. The clip is typically made of thin copper, which is relatively flexible and yet can absorb most of the electromagnetic emissions in the neighboring vicinity. The clip is held in place by clipping it to one of the two brackets, as well as by the pressure exerted on the clip by the two brackets.

Another approach known in the art is a mesh approach. Similarly a mesh that is longitudinal in size is provided in between the brackets of two neighboring card modules having electromagnetic

30

5 emitting electronic components. The mesh is typically made of steel wires, which is also flexible and being able to absorb the electromagnetic emissions in the neighboring vicinity. The mesh is typically held in place by gluing it to the side of one of the two brackets using adhesives, as well as by the pressure exerted on the
10 mesh by the two brackets.

As will be described in more detail below, the present invention provides an alternative approach that is easier to handle and less costly than either one of these approaches.

15

SUMMARY OF THE INVENTION

A longitudinal electromagnetic emission sealer is constituted with an elongated elastomer core and a thin helical outer skin
20 wrapped around the core. The elongated elastomer core is made of a flexible material, such as urethane, that allows the core to be compressed in volume when pressure is exerted on the sealer. The helical outer skin is made of a material that can absorb electromagnetic emissions, even at minimal thickness, such as stainless steel, allowing
25 the skin to wrap around the core in a helical manner easily.

In a complementary manner, a groove is provided to one side of the bracket of each card module. The groove and the sealer are complementary in size, allowing the sealer to be attached to the bracket
30 by snugly fitting a portion of the sealer into the groove. As a result, when a card module whose bracket is fitted the sealer of the present invention along one of its sides, is placed side by side with another card module,

5 the sealer is disposed in between the two brackets. In addition to the pressure exerted by the walls of the groove, the sealer is further held in place by the pressure exerted by the brackets. Once put in place, the sealer absorbs the electromagnetic emissions generated by the neighboring card modules.

10

BRIEF DESCRIPTION OF DRAWINGS

The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:

15 **Figure 1** illustrates an exposed rear perspective view of an exemplary digital system incorporated with the teachings of the present invention;

20 **Figures 2a - 2c** illustrate a side view, a top view, and a cross sectional view of the inter-bracket electromagnetic emission sealer of the present invention;

Figures 3a-3c illustrate a perspective view, a side view, and a top view of the improved card module bracket of the present invention;

25 **Figure 4** illustrates the relationship between the sealer and the groove in further detail.

DETAILED DESCRIPTION OF THE INVENTION

30

In the following description, for purposes of explanation, specific numbers, materials and configurations are set forth in order to

5 provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced without the specific details. In other instances, well known features are omitted or simplified in order not to obscure the present invention.

10

Referring now to **Figure 1**, which is an exposed rear perspective view of an exemplary digital system incorporated with the teachings of the present invention. Exemplary digital system **10** includes a number of card modules **12**, each having a number of electromagnetic emitting electronic components **24**. Electronic components **24** are disposed on circuit boards or cards **14**, which in turn are secured to brackets **16** respectively. Circuit boards **14** are functionally interconnected to each other and to other electronic components **26** of exemplary digital system **10** by electronically interconnecting circuit cards **14** to connectors **22** of "backplane" circuit board **20**. Additionally, longitudinal electromagnetic emission sealers **18** of the present invention are provided in between brackets **16** of card modules **12**, in accordance to the teachings of the present invention. Furthermore, brackets **16** of card modules **12** are improved in accordance to the teachings of the present invention to facilitate securing in place sealers **18**.

For ease of explanation, only a handful of card modules **12**, and a handful of electronic components **24** and **26** are shown. As will be appreciated by those skilled in the art, card modules **12** and electronic components **24** and **26** shown are for illustrative purpose only. Based on the descriptions to follow, those skilled in the art will appreciate that the present invention may be practiced in any digital systems having one or

30

5 more card modules, and any number of electromagnetic emitting electronic components. In fact, exemplary digital system **10** is intended to represent a broad category of card module based systems, including but not limited to any number of avionics or medical instrumentation systems, as well as rack mounted or tower based computer systems.

10

Figures 2a - 2c illustrate a side view, a top view and a cross-sectional view of one of the inter-bracket sealers **18** of the present invention respectively. The cross-sectional view of **Figure 2c** is taken along the axis X-X shown in **Figure 2b**. As illustrated, longitudinal
15 electromagnetic emission sealer **18** of the present invention is constituted with elongated elastomer core **50** and outer skin **52**. The length of sealer **18** is application dependent. In other words, it is dependent on the height of bracket **16**.

20

Elongated elastomer core **50** is made of a flexible material that allows sealer **18** to be compressed in volume when pressure is applied to sealer **18** by the adjoining brackets **16**. Preferably, the material used for core **50** is of a type that can provide at least 10 to 15 percent compression in volume. In one embodiment, urethane is used.
25 In an alternate embodiment, conventional hollow plastic surgical tube is used.

Outer skin **52** is used to absorb the electromagnetic emissions generated by electronic components **24** of card modules **12** in
30 the neighboring vicinity. Outer skin **52** is made of material that is capable of absorbing the electromagnetic emissions even at minimal thickness. As a result, outer skin **52** can be wrapped around core **50** easily. In one

5 embodiment, outer skin **52** is formed by wrapping a thin stripe of stainless steel around core **50** in a helical manner. As will be appreciated by those skilled in the art, the thickness of outer skin **52** is dependent on the amount of electromagnetic emissions to be absorbed, the absorbency of the material used, and the amount of the surface area of
10 sealer **18** exposed.

Figures 3a - 3c illustrate the complementary improvement provided to each of brackets **16** for facilitating securing in place sealers **18**. As shown, bracket **16** is provided with flange **28** at one of its two
15 sides. Flange **28** in conjunction with main body **38** of bracket **16** form grove **30**. Preferably, the cooperative ends of both flange **28** and main body **38** of bracket **16** have a "dove tail" shape (see also **Fig. 4**). The size of grove **30** is complementary to the size of sealer **18**, allowing sealer **18** to be partially, but snugly fitted in grove **30** to secure in place
20 sealer **18** along the side of bracket **16**.

Except for flange **28** provided to form grove **30**, bracket **16** is otherwise a conventional bracket made of conventional material having conventional features such as countersinks **32** for securing bracket **16** to
25 a rear panel of the chassis of exemplary system **10**, using screws **36**, and cutouts **34** for exposing connectors of card **14**.

Figure 4 illustrates the size relationship between sealer **18** and main body **38** of bracket **16** in further detail. While the sizes of the
30 features relative to each other are representative, they are not drawn to scale. In particular, the amount of "squeeze" the dove tail shaped ends **40** exert on sealer **18** is slightly exaggerated for illustrative purpose. For

5 the illustrated embodiment, the outer diameter of sealer **18** is .107 of an inch, whereas the opening of groove **30** is .097 of an inch. The depth of groove **30** is 0.077 of an inch. In other words, the width of the opening and the depth of groove **30** is about 95% and 75% of the diameter of sealer **18**. As a result, more than half of sealer **18** is snugly fitted inside
10 groove **30**, with less than half of the sealer **18** being exposed between brackets **16** of two card modules **12**.

Thus, an apparatus for sealing electromagnetic emission has been described. While the apparatus of the present invention has
15 been described in terms of the above illustrated embodiments, those skilled in the art will recognize that the invention is not limited to the embodiments described. The present invention can be practiced with modification and alteration within the spirit and scope of the appended claims. The description is thus to be regarded as illustrative instead of
20 restrictive on the present invention.

5 CLAIMS

What is claimed is:

- 10 1. A longitudinal electromagnetic emission sealer designed to be placed in between a first and a second bracket of a first and a second card module of a digital system for absorbing electromagnetic emissions generated by electronic components of the first and second card modules, the sealer comprising an elongated elastomer core having a volume compression characteristic of a predetermined percentage range,
15 and an outer skin of electromagnetic emission absorbing material wrapped around the elastomer core.
- 20 2. The longitudinal electromagnetic emission sealer as set forth in claim 1, wherein the elongated elastomer core is made of urethane.
3. The longitudinal electromagnetic emission sealer as set forth in claim 1, wherein the elongated elastomer core is a hollow plastic tube.
- 25 4. The longitudinal electromagnetic emission sealer as set forth in claim 1, wherein the outer skin is wrapped around the elongated elastomer core in a helical manner.
- 30 5. The longitudinal electromagnetic emission sealer as set forth in claim 1, wherein the outer skin is a thin strip of stainless steel.
6. A bracket designed to be used in a card module for mating with a circuit card of the card module, the circuit card having a plurality of

5 electromagnetic emitting electronic components, wherein the bracket
comprises a main body having a first size, and a flange disposed along
the first size to cooperate with the main body to form a grove for partially,
but snugly securing in place along the first side a longitudinal
electromagnetic emission sealer for absorbing electromagnetic emissions
10 generated by the electronic components.

7. The bracket as set forth in claim 6, wherein the main body has a
first dove tail shaped end at the first size, and the flange also has a
second dove tail shaped cooperative end.

15

8. The bracket as set forth in claim 6, wherein the longitudinal
electromagnetic emission sealer is cylindrical in shape having a diameter,
and the grove has an opening having a width and a depth that are about
95% and 75% of said diameter respectively.

20

9. A card module comprising a circuit card having a plurality of
electromagnetic emitting electronic components, and a bracket mating
with the circuit card, wherein the bracket comprises a main body having a
first size, and a flange disposed along the first size to cooperate with the
25 main body to form a grove for partially, but snugly securing in place along
the first side a longitudinal electromagnetic emission sealer for absorbing
electromagnetic emissions generated by the electronic components.

10. The card module as set forth in claim 6, wherein the main body of
30 the bracket has a first dove tail shaped end at the first size, and the
flange also has a second dove tail shaped cooperative end.

- 5 11. The card module as set forth in claim 10, wherein the longitudinal electromagnetic emission sealer is cylindrical in shape having a diameter, and the groove has an opening having a width and a depth that are about 95% and 75% of said diameter respectively.
- 10 12. A digital system comprising:
 a first card module having a first circuit card including a first plurality of electromagnetic emitting electronic components, and a first bracket mating with the first circuit card, the first bracket having a first main body including a first size, and a flange disposed along the first side
15 to cooperate with the first main body to form a groove;
 a longitudinal electromagnetic emission sealer partially, but snugly fitted in the groove, the longitudinal electromagnetic emission sealer having an elongated elastomer core and an electromagnetic emission absorbing outer skin wrapped around the elongated elastomer core;
20 a second card module having a second circuit card including a second plurality of electromagnetic emitting electronic components, and a second bracket mating with the second circuit card, the second bracket having a second main body including a second side, the second card module being disposed in parallel to the first card module with the
25 second side of the second main body exerting pressure on the longitudinal electromagnetic emission sealer.
- 30 13. The digital system as set forth in claim 12, wherein the elongated elastomer core of the longitudinal electromagnetic emission sealer is made of urethane.

5 14. The digital system as set forth in claim 12, wherein the elongated elastomer core of the longitudinal electromagnetic emission sealer is a hollow plastic tube.

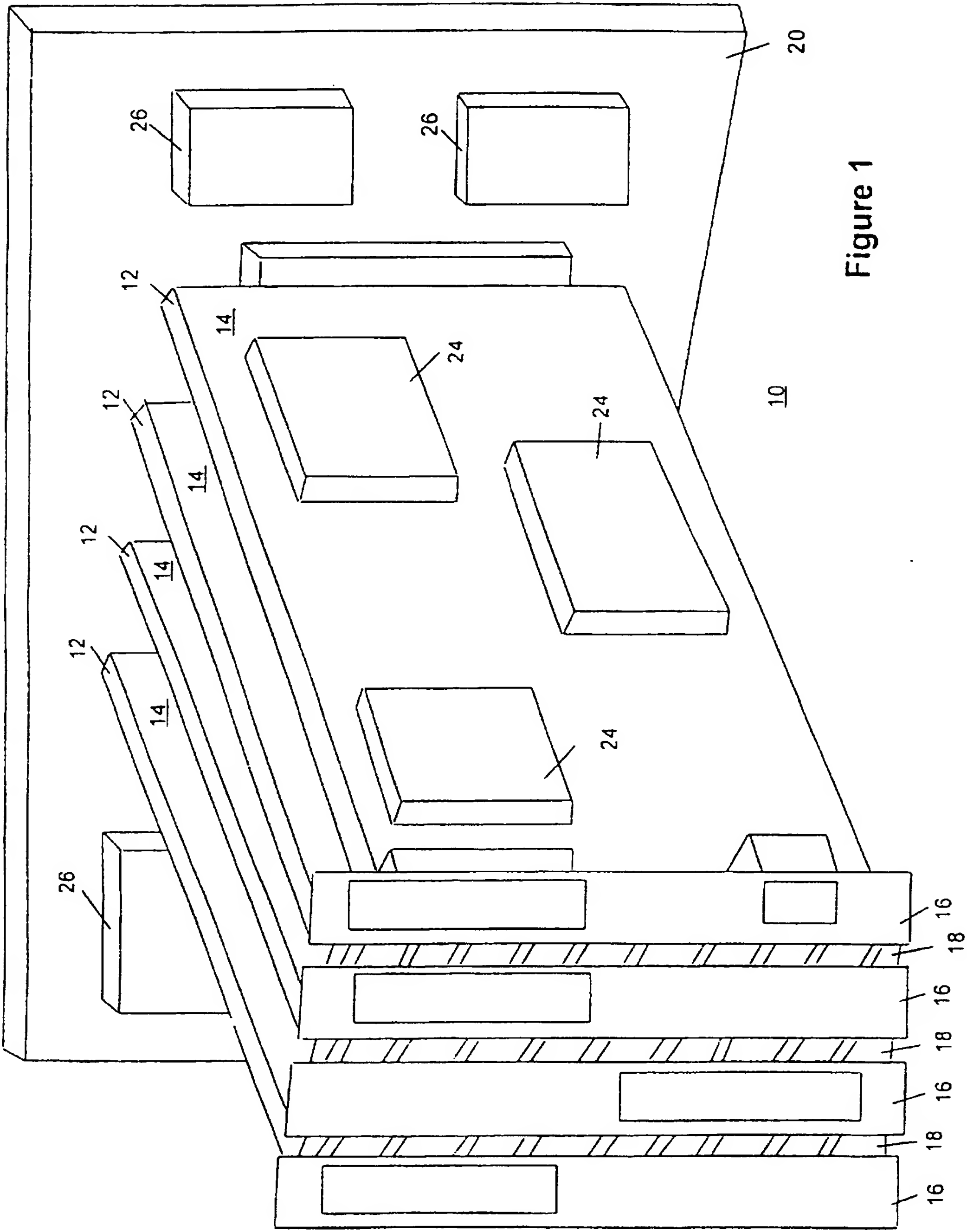
10 15. The digital system as set forth in claim 12, wherein the outer skin of the longitudinal electromagnetic emission sealer is wrapped around the elongated elastomer core of the longitudinal electromagnetic emission sealer in a helical manner.

15 16. The digital system as set forth in claim 12, wherein the outer skin of the longitudinal electromagnetic emission sealer is a thin strip of stainless steel.

20 17. The digital system as set forth in claim 12, wherein the first main body of the first bracket has a first dove tail shaped end at the first size, and the flange also has a second dove tail shaped cooperative end.

25 18. The digital system as set forth in claim 17, wherein the longitudinal electromagnetic emission sealer is cylindrical in shape having a diameter, and the groove has an opening having a width and a depth that are about 90% and 70% of said diameter respectively.

19. The digital system as set forth in claim 12, wherein the digital system is a computer system.



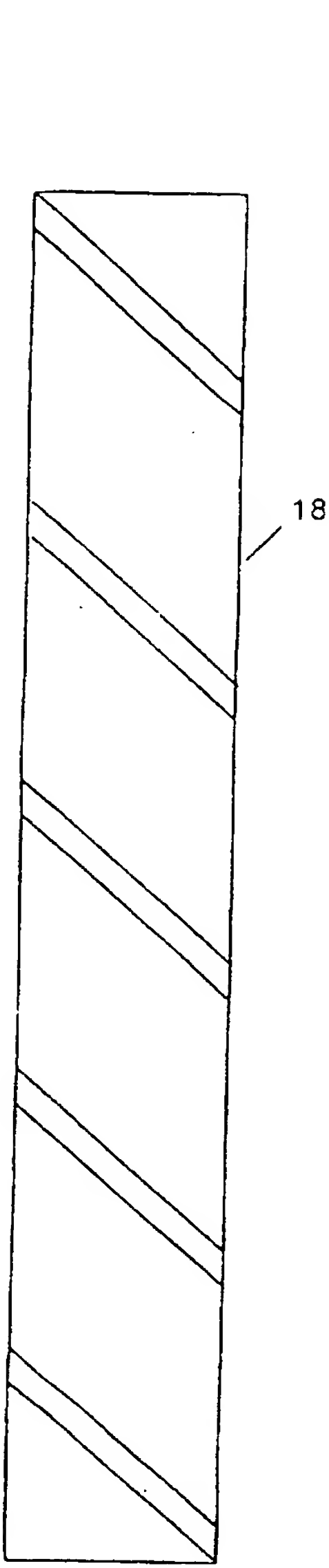


Figure 2a

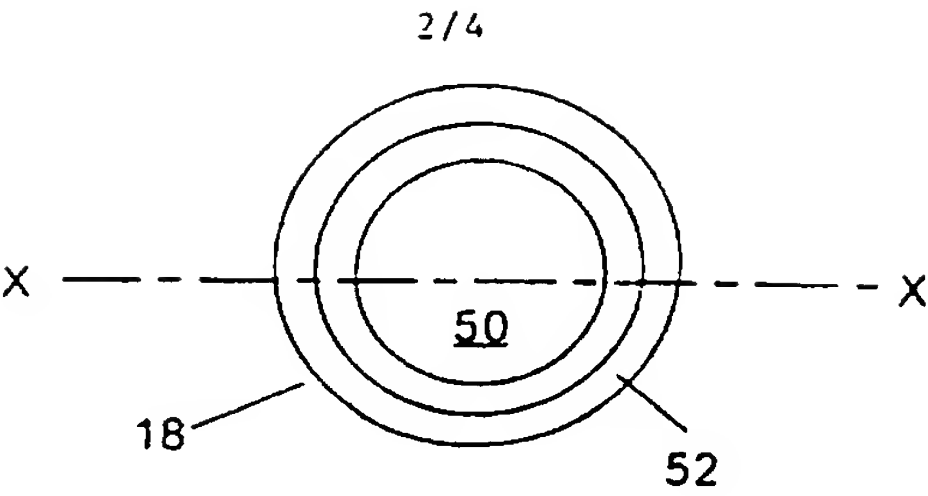


Figure 2b

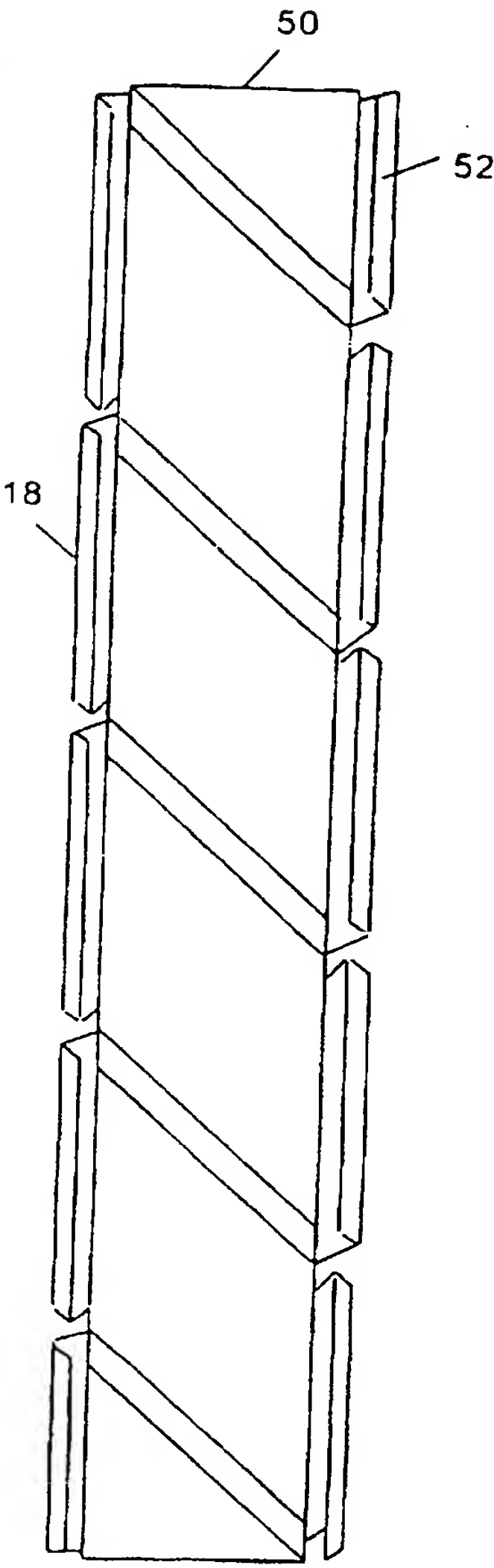


Figure 2c

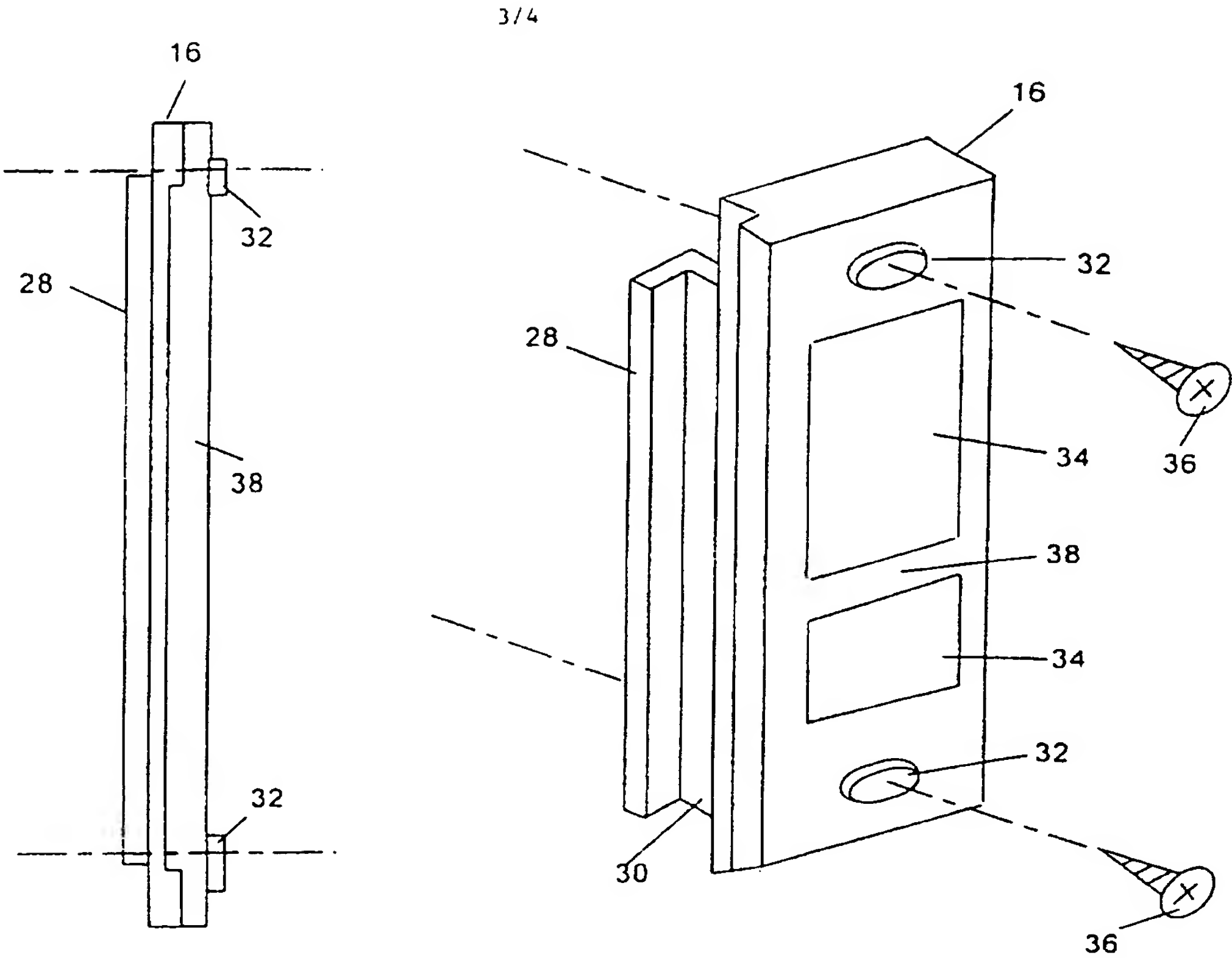


Figure 3b

Figure 3a

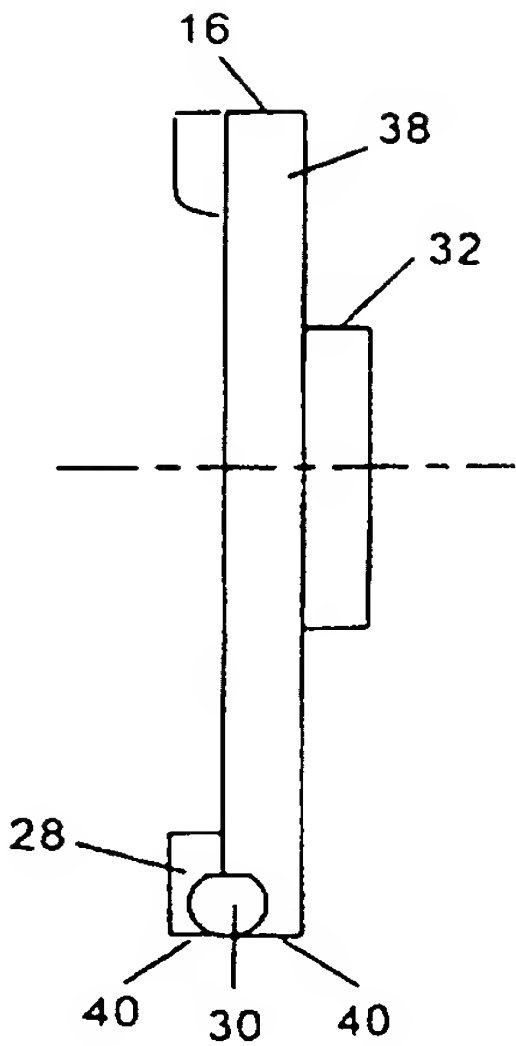


Figure 3c

4/4

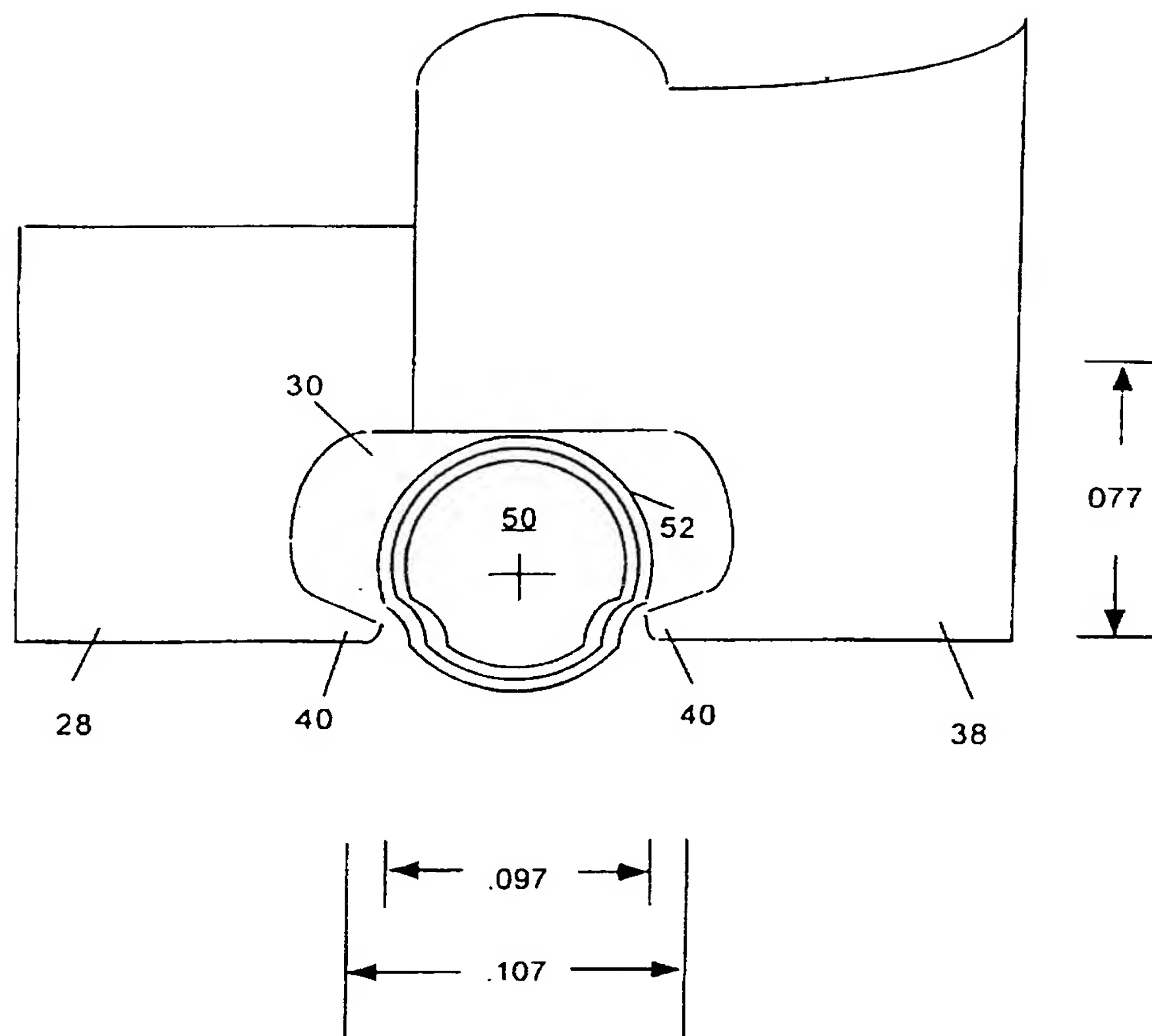


Figure 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/20679

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H05K 9/00

US CL :174/35R, 35GC;

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 174/35R, 35GC;

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 4,966,637 (Laborie) 30 October 1990, col. 3, lines 19-26 and fig 1	1, 4, 5 ----- 12, 13, 15-19
X ----- Y	US 4,857,668 (Buonanno) 15 August 1989, Col. 4, lines 59-61	2 ----- 12, 13, 15-19
X ----- Y	US 5,120,903 (Tam) 09 June 1992, FIG 11	6-8 ----- 9-19
Y	US 4,977,295 (Chin et al) 11 December 11, 1990, Fig. 2	3, 14

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

18 MARCH 1997

Date of mailing of the international search report

16 APR 1997

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

KRISTINE KINCAID

Telephone No. (703) 308-8640

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/20679

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,068,493 (Benn, SR. et al.) 26 November 1991, Fig. 3	3, 14
Y	US 5,233,507 (Gunther et al) 03 August 1993, Fig. 1	9-19